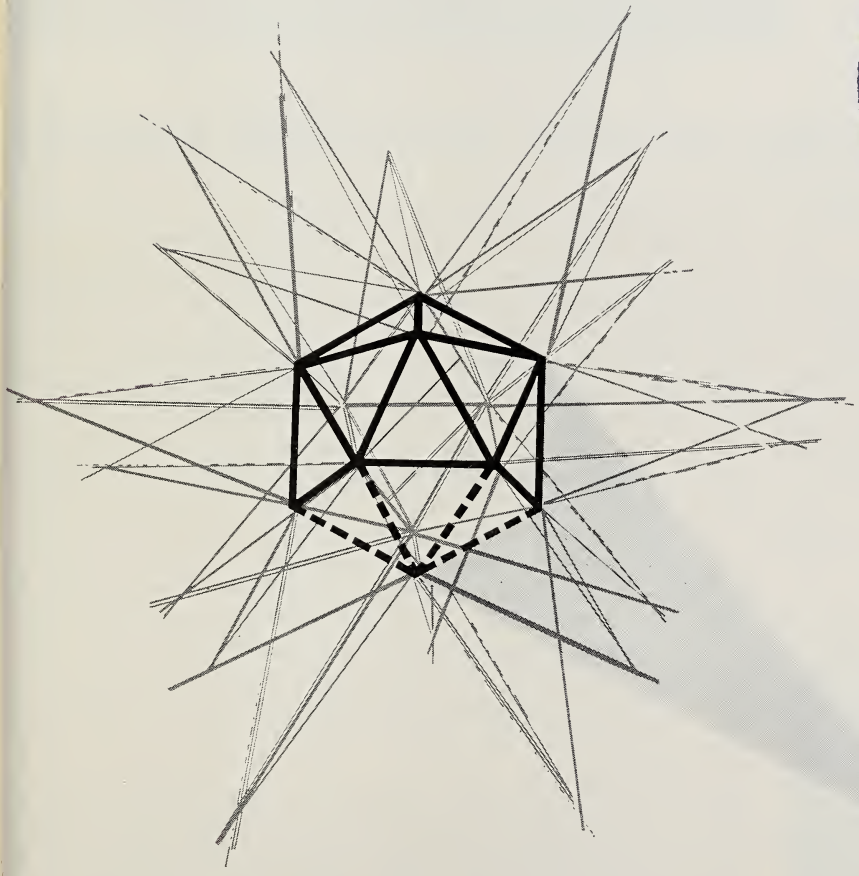
AGRICULTURAL Research

December 1962/U.S. Department of Agriculture



AGRICULTURAL
Research

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Destination, Beltsville

Visitors from nearly three fourths of the world's nations traveled millions of miles to the Agricultural Research Center, Beltsville, Md., during the last year.

This is an impressive fact. So is the fact that 154 countries now import products from U.S. farms.

Foreign travelers to Beltsville included heads of state (the vice premier of the Congo in October), agricultural teachers and leaders, businessmen, journalists, and farmers.

Although their interests are as diverse as world agriculture itself, they all want an answer to this question: How is it possible that each acre of land used for U.S. crops last year produced about two thirds more than each acre in 1920?

These foreign visitors recognize that the vigor of a nation is correlated closely with the health of its agriculture.

The most important help we can give to emerging nations may well be to share our technology in production of food and in protection of natural resources.

Today's U.S. position of world leadership has been enhanced by imaginative scientists working to solve the basic long-range needs of American agriculture: reduced costs, improved quality, and expanded markets.

As the world's population grows, the importance of these creative scientists—and their techniques—will grow with it.

The U.S. will need 40 percent more food, feed, and fiber in less than 20 years. The technology gained by scientists in meeting this U.S. goal will be available to help peoples of the world meet their needs.

The job can and will be done—even in the face of diminishing acres for crops, pasture, and range.

It will take science and technology, of course, to make this possible. We must maintain a constant flow of research results. Long-range investigations that may solve some of the complex problems of 1980 are already underway.

The changes that science itself produces make technology our most versatile and unpredictable resource.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Plant environment zone is examined in basic research for new understanding of physical laws

Energy Balance and Water Use

■ What happens in the plant environment zone largely determines how much water is used by crops. An understanding of the physical laws operating in this zone—extending about 5 feet above the ground and 5 feet below—therefore is among the first steps in learning how to use water more efficiently for economical crop production.

In basic research at the U.S. Water Conservation Laboratory, Tempe, Ariz., ARS scientists are seeking ways to determine the physical forces that govern water use by irrigated crops in arid areas. Precision instruments and automatic data-recording equipment are making these studies possible for the first time.

Scientists know that about 70 percent of the rainfall absorbed by U.S. soils either evaporates or is transpired by plants. Before this loss can be substantially reduced, research must answer questions like these:

Of the total water consumed in crop production, what part is used in transpiration by plants and what part is lost by evaporation? Can transpiration be reduced without restricting plant growth processes? If transpiration can be reduced, will this increase the evaporation by the same amount, or vice versa? What is the relation between crop management (kinds of crops, orientation of rows, distance between rows) and radiant energy used in evaporating water?

Present research is not aimed at immediate practical solution of these problems. But physicist C. H. M. van Bavel and meteorologist L. J. Fritschen are collecting information upon which they hope ultimate solutions can be based.

For example, they are investigating the disposition of radiant energy from the sun within the plant environment zone. This includes energy that is expended and energy that is stored. Both vaporization of water from the soil surface and transpiration of water from the plant require energy. Hence, energy studies indirectly supply facts on the extent of these processes. Some energy also is stored as heat in the air, the soil, the crop, or bodies of water.

Energy is in a constant state of movement within the plant environment zone: some passes from air to soil or water and some moves from soil or water to air. The amounts and direction of this energy movement are governed by physical laws not completely understood.

Turn Page

The plant environment zone is studied by means of lysimeters, underground earth-filled tanks mounted on scales. Soil-moisture loss or gain is recorded.

Data from lysimeters, meteorological instruments are recorded automatically, logged on tape, and analyzed by high-speed digital computers.

Energy Balance and Water Use

(*Continued*)

Van Bavel and Fritschen are measuring the magnitude of four factors that they call energy balance components. These four factors account for all energy movements and are in balance at the soil surface. This energy balance is expressed by the formula $R_n+S+LE+A=0$ (Zero).

R_n is net radiation—the amount coming directly from the sun and sky minus the energy reflected and reradiated by the earth's surface.

S is the heat flow into the soil.

A is the heat transferred into air by turbulence or diffusion.

LE is the energy used in evaporation, in which L is the heat required per unit of water in vaporization, and E is the rate of evaporation.

These energy balance studies are made with special recording instruments. E is measured by precision-weighing lysimeters—metal tanks of soil whose weight changes with addition or evaporation of water. R_n and S are measured by meterological instruments in or over the lysimeters. A is calculated after other values are inserted in the equation. L is a constant figure for a given temperature.

All data are automatically recorded on tape, ready for transfer to automatic computers. Forty-nine items of data can be collected every 5, 10, 15, 30, or 60 minutes, as determined by the operator.

The energy balance studies have been made under three conditions: With drying soil, with a large shallow water area, and with isolated shallow water surrounded by dry soil. Current experiments are underway with growing crops.

Results so far indicate that an evaporating surface does not usually extract energy from the air on a 24-hour basis. This finding is contrary to expectations in a hot, arid climate. The scientists found that evaporation is primarily determined by net radiation; windspeed acts as a modifier of less importance. Also, evaporation from a wet soil surface was 18 percent higher than from shallow open water.☆

Twelfth in a Centennial Series

Many animal diseases, pests have been wiped out, but the battle continues to insure . . .

Healthy Herds and Flocks

■ "Insects carry many diseases of man and animal."

Had this statement been made to any scientific group a hundred years ago, the speaker would have been laughed at; his assertion would have been considered ridiculous.

Three decades would pass before the statement could be made with confidence. First to make the discovery, in 1890, were three USDA scientists—Theobald Smith, F. L. Kilborne, and Cooper Curtice. They proved a livestock disease was being spread by ticks from animal to animal.

Their research, which cost $65,000, led to the eradication of cattle tick fever. Freedom from the tick is worth about $40 million a year to the livestock industry. More important, the discovery helped others successfully combat malaria, yellow fever, and many other insect-borne diseases.

Highlights of animal disease and parasite research during the past 100 years also include—

Discovery that hog cholera is caused by a virus and development of virus-serum method of immunization. With slight modifications, the method

Vaccination protects livestock against numerous killing or injurious diseases, such as blackleg, thereby safeguarding the Nation's meat supply.

Electron microscope searches for disease organisms like that of anaplasmosis.

Domestic livestock diseases are studied at national laboratory opened last year

is being used today to aid in the Nationwide effort to eradicate this fatal disease of hogs.

Finding a treatment to rid dogs of hookworms. This treatment was later used against hookworms in humans. It materially increased the productivity of Southerners, long sapped of energy by hookworms.

Development of a vaccine to control abortion disease of cattle. The vaccine is now used in 30 countries to immunize against brucellosis—the most important cause of cattle abortions and an ailment that often causes subsequent infertility. (Brucellosis-infected animals are the source of undulant fever in man.)

Proof that the virus causing vesicular exanthema of swine is spread mainly in uncooked garbage, a common diet for these animals. Backed by this information, communities passed and enforced garbage-cooking laws. And vesicular exanthema, which raged through the country in 1952, causing serious weight losses and weakening affected hogs, was wiped out in 1959.

Detection of chemical residues in meat and other animal food products. Ways to gage the amounts of residues have been found.

Identification of a plant called California false hellebore, as the cause of "monkey-faced" lambs. The condition was long thought hereditary until ARS scientists found that pregnant ewes, after eating the plant, gave birth to malformed offspring.

Studies underway today will be equally fruitful. Some will undoubtedly take their place in a list of outstanding research accomplishments of the twentieth century. Meanwhile, three examples of unconquered maladies show reasons to press ahead on research.

Anaplasmosis of cattle prevails, although ARS scientists have worked on it more than 35 years. The disease—sometimes chronic, often fatal—is present in 30 States and gradually getting into others. An infected cow may recover, but she can carry and spread the disease agent the rest of her life. Tests have been developed to spot such carriers. Also, use of an electron microscope has helped ARS scientists identify the causative organism—a blood parasite—which may act like a virus.

Foot-and-mouth disease is still the most dangerous of foreign livestock disorders. It could break out again in this country as it did in 1929. USDA research identified a possible source of such an outbreak by proving the disease virus can live in lymph tissue after meat is cured. This information has provided regulatory officials with a scientific basis for restricting imports of meat from countries where the disease occurs.

Chronic respiratory diseases account for more than half of all poultry condemnations during processing. Current research seeks answers to this basic question: Are these ailments caused by a virus, the bird's environment, or both? When scientists learn the cause, they may be able to find ways to prevent the disease.

More than $2 billion is lost yearly to infectious, noninfectious, and parasitic diseases of livestock. Research will lead to control of some, eradication of others, and side benefits of incalculable value to those studying afflictions of man.☆

Radiation-Induced Mutations

The atom opens up new avenues for improving asexual plant varieties

■ A new use for the atom in agriculture may be opening up.

Two recent ARS-State studies have demonstrated that radiant energy may be helpful in developing improved varieties of forage grasses that reproduce by asexual seed.

Both studies showed that atomic radiation will induce true mutations in dallisgrass, an important forage species in the South.

Dallisgrass seed develops without fertilization, and the resulting plants cannot be improved by conventional methods of crossbreeding. Attempts have been unsuccessful in developing superior lines of dallisgrass by planting seed of individual plants that appear superior. Dallisgrass has low natural fertility, among other disadvantages.

Irradiation of common dallisgrass seed produced tremendous changes in growth habits and structure of plants studied in cooperative research at the Texas Agricultural Experiment Station. Geneticist E. C. Bashaw of ARS and plant breeder B. J. Hoff of Texas found that the changes were passed on uniformly to progeny.

The results illustrate that radiation can produce a multitude of mutations that would not otherwise be available for evaluation. Hundreds of strains of dallisgrass, both domestic and foreign, had been examined previously without finding any with the growth and structure characteristics induced by radiation.

NORMAL common dallisgrass shows plant's typical growth pattern.

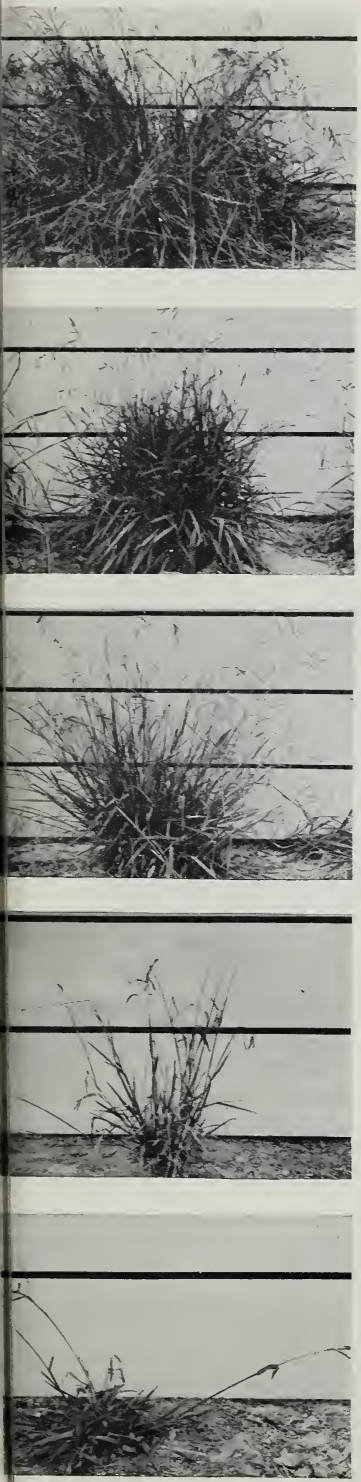
Bashaw and Hoff point out that the wide range of heritable changes induced in dallisgrass indicate that radiation may prove extremely useful in improving growth characteristics of asexual species. They caution, however, that this may be difficult without seriously reducing the fertility of the species. Many of the irradiated dallisgrass plants showed drastic reductions in fertility.

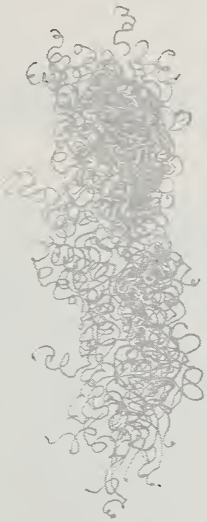
Another set of experiments, conducted in cooperation with the Georgia Agricultural Experiment Station, confirmed the fact that exposure of dallisgrass seed to radiant energy will induce true mutations. ARS geneticists G. W. Burton and J. E. Jackson performed the tests with prostrate dallisgrass. an introduced strain from Uruguay.

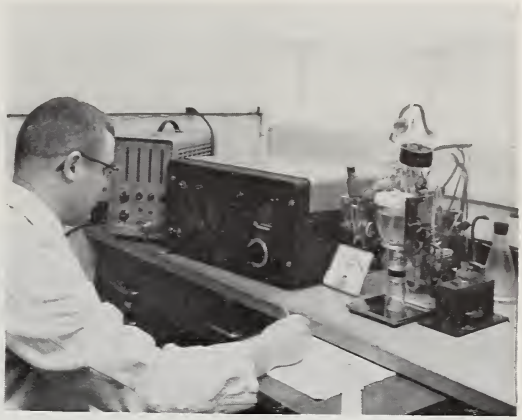
Burton and Jackson also concluded that the radiation will not produce a sexual form of prostrate dallisgrass or even a sexual variant with any degree of regularity. Many asexual species produce occasional sexual variants. Failure of the radiant energy to break asexuality in prostrate dallisgrass indicates that the road to improvement lies through use of artificial mutants.

Irradiated plants in the Georgia tests were also studied, without significant result, for evidence of ergot resistance, increased forage yield, and seed productivity.☆

RADIATED dallisgrass plants (at right, top to bottom) vary greatly from normal. They are more erect, more prostrate, or dwarfed.







Wool fibers are counted and sized electronically in a unit adapted from a blood cell counter-sizer.

Now, Wool Fibers Can Be Measured Electronically

■ An electronic process of measuring wool fiber fineness that is much faster and more precise than the standard visual microscopic technique has been developed through ARS research.

Used by scientists in studies of wool-fiber characteristics, the electronic method may also prove valuable in the worsted industry—particularly in selecting combed wools for spinning yarns of desired sizes for various worsted fabrics.

The instrument adapted for measuring wool electronically was developed originally for counting and sizing blood cells. It also has been modified and used with some success in measuring some synthetic fibers.

The technique for use with wool was developed by chemists R. A. O'Connell and R. J. Martsch at the Western utilization research laboratory, Albany, Calif.

In this new process, a sample of combed fiber is machine cut into precise sections 100 microns long (about four thousandths of an inch). These 100-micron sections are then dispersed in a liquid that is electrically conductive. Each fiber particle is electronically counted and sized as this fluid is drawn through a small opening.

The electronic unit is triggered to count and measure the change in resistance as fiber particles pass through the opening. The resistance change, registered as an electrical impulse, is a measure of particle size.

Since the fibers are all the same length, their diameter or firmness can be calculated by simple arithmetic.

Electronically, a fineness analysis can be made in less than an hour. In contrast, the standard microscopic method requires 4 to 8 hours. The new method is more accurate because thousands more fibers are checked, and it is more reliable because the instrument's "eyes" do not tire.☆

Vegetation, mulches, and dams are studied to find best methods of preventing gully erosion

Healing Potions for

Best measure of protection in the tests was a control that combined use of mulch, grass, trees, and brush dam.

■ Some of the Nation's most damaging gullies are now research sites where USDA and Mississippi scientists are seeking basic knowledge on how gullies produce sediment and how gully growth can be arrested.

These gullies—18 are included in the study—are located in the hill country of north central Mississippi, an area drained by the Yazoo River and its tributaries. Tons of sand eroding from the gullies, which range in depth from 20 to 40 feet, fill stream channels and reservoirs, causing them to overflow. In proportion to the area covered, these gullies contribute a far greater percentage of sediment than do other land surfaces in the watershed.

The studies, aimed at finding ways to help eliminate flooding of valley lowlands, are being conducted by ARS hydraulic engineers at the U.S. Sedimentation Laboratory, Oxford, Miss. This laboratory is operated in cooperation with the Mississippi State University and the University of Mississippi.

Combination plantings are tested

With assistance from USDA's Soil Conservation Service, the researchers built small dams at the outlet of each of the 18 gullies to trap and hold sediment where it could be measured accurately. They then established mulches and plantings of trees, grasses, and legumes in some gullies and left others unprotected.

During the first 5 years of the studies, soil washed from unprotected gullies ranged annually from 230 to 1,555 tons per acre of gully surface.

Most soil washing occurred where the exposed gully surface had the highest sand content and covered the greatest area. Other factors influencing sediment production were steepness of land configuration and erodibility, permeability, and surface-sealing tendency of the soil.

Soil Wounds

Sediment fills in behind pools

The dams constructed at the gully outlets continued to hold back sediment even after the pool was filled with sand. Sediment then settled out progressively farther up the floor of the gully above the pool. This continued until the sediment-covered gully floor had the same profile as the floor of the gully before deposition began. These deposits helped retard further gully erosion, as did vegetation established in the gullies when the dams were constructed.

By measuring the amount of sediment held by the dams, the engineers determined the effectiveness of erosion-restricting treatments. Least erosion occurred in gullies that had a combination of mulch, trees and grass, and brush dams. One gully produced 62 percent less sediment and another 84 percent less than nearby unprotected gullies produced.

Single measures work but not as well

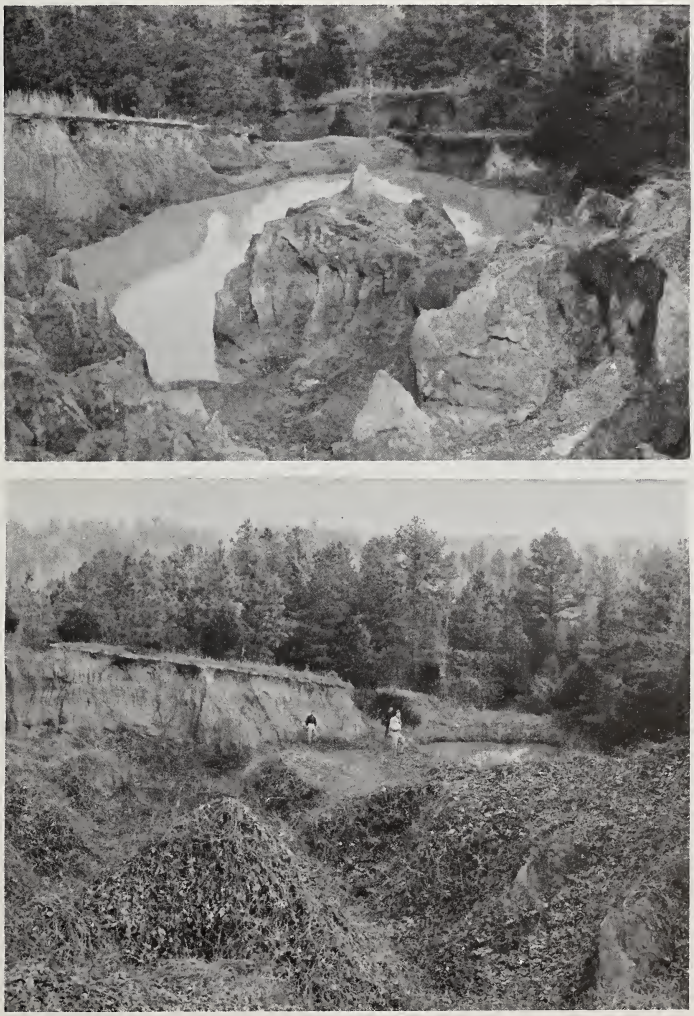
Erosion was also reduced in gullies protected with one or more of the stabilizing treatments, but this reduction was not as great as in gullies stabilized with all the erosion-restricting treatments.

Physical characteristics of the gullies—variations in geologic formations and in amounts of exposed gully area—also influenced soil erodibility.

Information gained in these studies is being used by the Oxford laboratory as the basis for further research on the basic processes involved in gully formation and on conservation methods to control gullies and reduce damage from sedimentation.☆

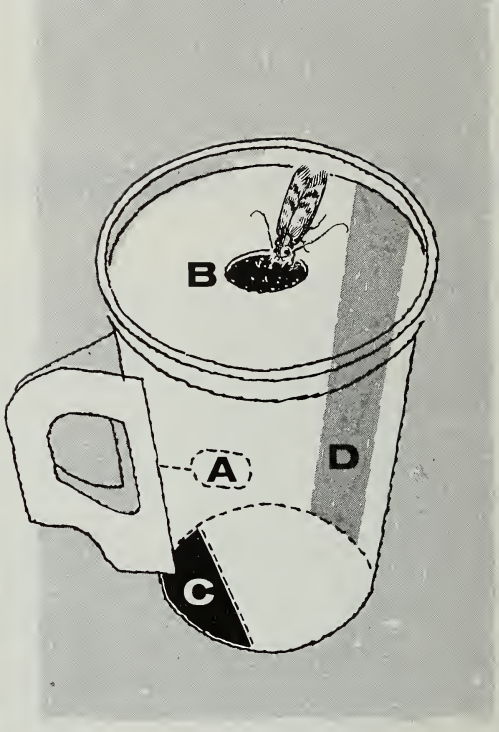
BEFORE gully received treatment (top photo), it displayed ragged terrain typical of the 18 gullies included in the study.

AFTER Kudzu was planted (bottom photo), erosion was reduced by heavy ground cover. Kudzu was not, however, best cover tested.



Pink Bollworm Attractant

Natural lure attracts male moths to traps in Mexico tests



Paper cup serves as inexpensive trap. Moth is attracted into the cup by a small amount of lure on filter paper (A) through either opening (B or C). It then gets tangled in sticky surface of fly paper (D).

ARS entomologist M. T. Ouye inspects one of the traps in field tests at Torreon, Mexico.

■ The male pink bollworm moth can be lured into traps with a sex attractant from young virgin moths, ARS field tests at Torreon, Mexico, have shown.

In future research, scientists may be able to combine the attractant with a pesticide bait or a chemosterilant as a possible control measure.

The pink bollworm, a constant threat to the U.S. cotton industry, has been confined to cotton-growing States west of the Mississippi River. Entomologists are now searching for a low-cost method of detecting this pest, which inflicted its greatest damage—nearly $30 million worth—in south Texas in 1952. (Damage is caused by the larva, which feeds on cotton bolls.)

Accurate determination of the limits of an infested area will reduce the cost of control.

Terminal segments of abdomen used

The natural attractant—terminal segments of the abdomen of female moths 3 to 4 days old—was discovered by a team of ARS entomologists, headed by M. T. Ouye and B. A. Butt, in laboratory work at Brownsville, Texas. The ARS field work, in cooperation with Mexico's Department of Agriculture, confirms the earlier laboratory findings.

The lure attracted only the male pink bollworm moths—and as effectively as living females.

Eight-ounce paper drinking cups were adapted for use as insect traps and hung 3 feet from the ground on metal stakes. Field tests began in

May 1962 and lasted through the summer.

Some of the traps contained a lure extracted from 10 female moths; others, an attractant from 100 moths. This gave a comparison of the response of male moths to lures of two different strengths.

On the first night traps were set out, cups containing the low-concentrate lure caught approximately the same number of male moths as traps containing the high concentration. On subsequent nights, however, the traps containing higher concentrations caught more male moths. The lure is effective in the field for one week.

Catch increases as season progresses

Catches of higher numbers were made in the late summer, when the population had increased. Several generations of pink bollworm occur during the growing season, and the population generally increases as the season progresses.

The ARS scientists believe the pink bollworm natural sex lure offers as bright a future as did the gypsy moth sex attractant discovered a few years back. The natural gypsy moth sex lure substance later was chemically identified and inexpensively manufactured as a synthetic. This synthetic attractant has proved to be an economical and effective tool in detecting gypsy moth infestations.

Scientists now hope to identify and synthetically manufacture a successful pink bollworm sex lure, which would aid greatly in future control efforts. However, USDA officials are confident that even if a synthetic pink bollworm sex lure is *never* available, the natural lure will still be useful. Sufficient material can be extracted from young moths to provide an inexpensive attractant for detecting the pest and defining the limits of any given infestation.☆

A Time Clock Study: Feeding Habits of the Steer

■ Individually penned steers ate an average of 12 times and spent 4½ hours a day (24 hours) at feedbunks in USDA studies of feeding behavior. Feeding times varied, animal to animal and feed to feed.

ARS animal husbandman P. A. Putnam and associates found that three-fourths of the feeding was done by the steers during daylight hours. The animals ate day and night, however, for at least 10 minutes of each 3-hour period. The researchers say that the feeding habits of these individually penned steers are similar to those observed in previous tests with pasture animals.

The penned animals spent an average of 4 hours eating a grain ration and 5 hours on a high-roughage diet. They required 2 hours longer to eat a given amount of ground feed (5½ hours) than when the feed was pelleted (3½ hours).

Proof that steers like to eat around the clock—substantiated in this study—helps explain why animals fed frequently usually outgain those fed only once or twice a day. Some cattlemen recognize this by never letting feedbunks become empty. They feed to satisfy the animal's needs, rather than when it is most convenient.

Photoelectric cells and timers were used in four individual pens to collect the data in these studies at the Agricultural Research Center, Beltsville, Md. As the test steer lowered his head into a feedbunk, he broke a photoelectric circuit, which activated a timer and recorded his visit. When he removed his head, the circuit was restored.

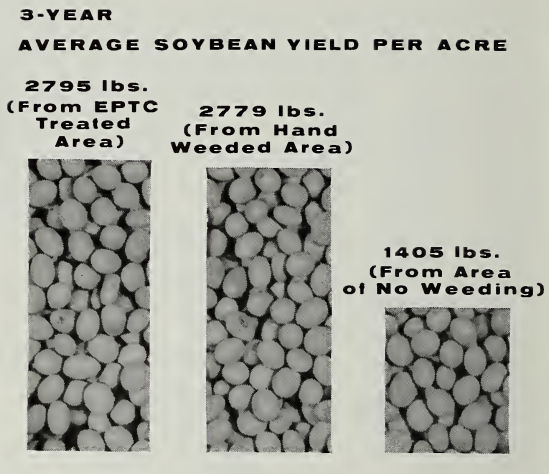
For future tests, the scientists will add equipment to each pen so they can observe the competition between two animals using only one bunk. (The feeder has space for only one animal at a time.)

A metal bar will be installed across each feedbunk with electrical leads from the bar to a timer. Then the researchers will put a chain around the neck of one of the two steers in the pen. The chain contact with the bar will activate a timer and record feeding of this steer. At the same time, the photoelectric cells will start the second timer and also record feeding of this steer.

These simultaneous recordings—one activated by the electric cells and the other activated by the chain and bar—will tell the scientists when the steer with the chain was feeding.☆

Preplanting application of EPTC betters more than 50 herbicides in . . .

Controlling Weeds In Irrigated Beans



■ A preplanting application of the herbicide EPTC proved the best of 50 herbicides tested for the control of annual weeds that infest field beans in Washington and Wyoming.

The 50 herbicides were evaluated for control of weeds in irrigated field beans at several locations in the two States. ARS scientists cooperated with the Washington and Wyoming Agricultural Experiment Stations in the research.

Other studies have shown that EPTC (ethyl N,N-*di-n*-propylthiolcarbamate) also provides good control of annual weeds in snap beans and that cereals and other sensitive crops may be sown safely following bean harvest. However, EPTC damages lima beans, soybeans, and blackeye peas and should not be used in these crops.

EPTC has been evaluated for weed control in field beans by a number of State experiment stations. It is registered by USDA for preplanting weed control in dry beans and snap beans; scientists suggest that bean producers get specific recommendations from their State stations and follow these recommendations and label instructions carefully.

Weeds killed by EPTC in the Washington-Wyoming tests include barnyard grass, lambsquarters, pigweed, nightshade, and yellow and green foxtail. The only annual weed not controlled was Russian thistle, which is not a major pest in field beans.

In Washington plots treated with EPTC, yields were the same as in plots weeded by hand—but nearly double the yield where weeds were not controlled. Average yields for 3 years were 2,795 pounds per acre in EPTC-treated plots, 2,779 pounds per acre in hand-weeded plots, and 1,405 pounds per acre with no weeding.

Apply EPTC on prepared seedbed

EPTC should be applied on the prepared seedbed either as a spray or in granular form, in bands or over the entire seedbed. Band application is less expensive. Following the first irrigation, it should not be applied until the top half-inch of soil has dried. And since the herbicide is volatile, it should be incorporated into the soil as quickly as possible with a rototiller, tandem disk, finger weeder, or rotary hoe.

The Washington station recommends an application rate of 3 pounds per acre. In Wyoming, the 3-pound rate is recommended for use on coarse-textured soils in areas that normally have rainfall during the bean-planting season. But up to 4 pounds per acre are recommended for fine-textured soils and in arid areas of the State.

The herbicide kills emerging weed seedlings for 6 to 8 weeks after it is applied. After this time, a vigorously growing bean crop provides such dense shade that weed seedlings die for lack of light.

The herbicide is effective whether ridge or sprinkler irrigation is used. However, the scientists advise growers not to disturb the treated soil between planting and the first irrigation because cultivation only hastens loss of the herbicide. The first irrigation normally is not necessary until 4 to 6 weeks after planting, unless unusually hot, windy weather occurs.

Small ridges should be used during the first irrigation, and care should be taken to avoid throwing soil into the bean rows. New weeds that appear on and along the ridges after irrigation can be destroyed by cultivation sweeps or knives set well away from the bean rows.

A larger ridge for the second irrigation will serve for the rest of the season. Soil can then be thrown on the rows if hilling is desired.☆

Growth of poinsettia at right, held back by chemical retardant, is more compact than growth of untreated plant.

Transforming The Poinsettia

Cyclic lighting, chemical growth regulator produce a shorter, more compact plant with darker green foliage

■ A shorter and more compact poinsettia plant with darker green foliage will be sold by nurserymen on many Christmas markets this year.

This transformed poinsettia has been made possible as a result of two cultural techniques developed by scientists in ARS and other agencies. The combined practices are—

- Cyclic lighting, and
- Treatment with a chemical that retards stem growth. The chemical, (2-chloroethyl) trimethylammonium chloride, is commonly called CCC.

Without cyclic lighting, a nurseryman has only 15 days, September 1 to 15, to start poinsettia cuttings. He must start them during this short span to produce plants of the desired size, 12 to 18 inches tall, in time for the market, December 12 to 20.

Cyclic lighting triples the starting period, enabling the nurseryman to start plants from August 1 to September 15 and bring them all into bloom at the desired time.

In the cyclic-lighting treatment, artificial light is used during the growth of the plant to control the development of flowering parts. Once cyclic lighting is discontinued, flowering parts develop that are timed for Christmas blooms.

An adverse effect of cyclic lighting—tall, spindly plants—is overcome with the chemical growth regulator CCC. Not only does CCC prevent ungainly stem development, it actually results in plants that are superior in some respects to poinsettias grown by conventional methods. CCC-treated plants do not wilt as readily as other plants, they are more compact, and they have a richer green foliage.

Research on both cyclic lighting and chemical growth retardants has been conducted previously by ARS scientists as well as by scientists in several State experiment stations and by private industry. ARS workers at Beltsville, Md., combined the two treatments for the first time in these experiments with poinsettias.

Natural plus artificial light

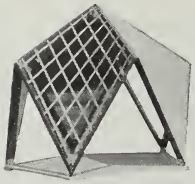
In preliminary cyclic-lighting tests, the ARS scientists placed plants on an 8-hour, natural-light day. They then supplemented this with artificial light at night at an intensity of 20 footcandles and at several time exposures. Results showed intermittent, short light exposures to be as effective in inhibiting flowering as continuous light for 4 hours.

One reason for varying light intensity and time of exposure was to try to develop light treatments more practical for commercial poinsettia houses. Commercial growers often are not equipped to provide light intensities greater than 10 footcandles.

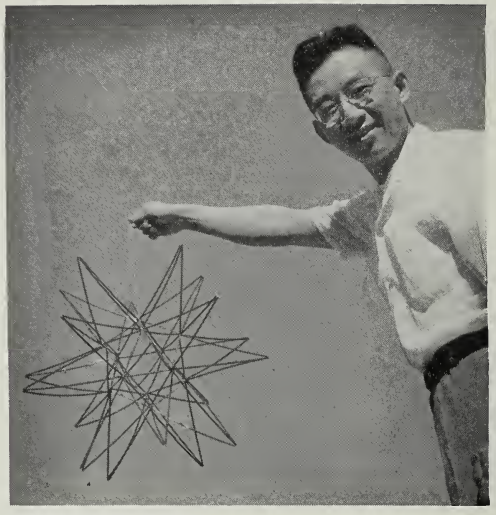
The minimum effective exposure, in total times and intensity, was 12 minutes of light at 5 footcandles. The exposure time was divided into five light periods of 2.4 minutes each, alternated with dark periods of 21.6 minutes each. This intensity was as effective in inhibiting flowering as the higher light intensities.

In preliminary ARS experiments with CCC, stem elongation was satisfactorily retarded with dosages ranging from 0.08 to 0.4 gram of active material per 3-inch pot of soil.

In the final tests, the chemical treatment that gave the most generally satisfactory results was one in which the soil was drenched with 0.4 gram of CCC per 3-inch pot 10 to 14 days after potting.☆



Idea for new farm building—model shown above—came from ornament made by ARS agricultural engineer R. C. Liu.



Christmas Ornament Inspires Design for New Farm Building

Structure is adaptable to many livestock, storage uses—supports 3 feet of snow

■ A new idea in farm buildings may be on the way—and all because of a homemade Christmas tree ornament.

ARS agricultural engineer R. C. Liu got the idea while making an ornament for his family Christmas tree. The ornament, a 20-ray star known geometrically as a radiant icosahedron, has 20 equilateral, triangular-shaped faces and 12 points.

The farm building Liu has designed is a modified icosahedron—a partial sphere with a pentagonal base formed by bolting together five diamond-shaped panels. He says it should be easy to mass produce the panels and to quickly erect buildings with them.

A conventional roof is often considered by engineers as a "structural liability" because it adds weight without adding structural stability. The new design adds very little weight and increases the structural stability.

Each of the panels, known to engineers as hyperbolic paraboloids (HP), is made of four identical 2 x 4's bolted together to form a frame in the shape of an elongated diamond. The frames are then covered with plywood, tempered hardboard, or other flexible materials to complete the panel.

HP panels combine convex and concave shapes that utilize the strength of flexible materials. They can withstand the downward pressure of heavy snow and the upward pressure of high wind because the curved shapes are positioned to pull against each other (AGR. RES., July 1961). In tests at the Agricultural Research Center, Beltsville, Md., where Liu is stationed, HP panels have supported loads of 30 pounds per square foot—the equivalent of 3 feet of snow.

Used as shelters or storage

Liu says single panels can be erected horizontally on supports for livestock shades, or they may be used vertically in combinations of 3 to 7 panels to build livestock shelters (hog houses, chicken houses, etc.), storage bins, or dwellings.

One of the most promising coverings for the new pentagonal building consists of a welded steel lattice work fastened across the diamond-shaped panel and covered with a 1½-inch layer of polyurethane, a light-weight foam plastic. The polyurethane is then coated with crushed rock held in place by a thin coating of neoprene-hypalon, a synthetic rubber.

The steel gives the panel strength; the polyurethane provides insulation, equivalent to 3 inches of most conventional insulation materials; and the crushed rock and synthetic rubber coating make the panel weather resistant. An 18-foot-high panel of these materials weighs 220 pounds.

Other coverings being tested at Beltsville include ¼-inch tempered hardboard and ⅜-inch plywood coated with synthetic rubber. Panels covered with these materials, however, weigh considerably more and provide very little insulation.

HP panels have been used in roof construction, but this is the first time they have been combined in making a roof and wall for farm buildings. The diamond-shaped panels are not commercially available, but Liu says the building industry has shown an interest in them.☆

Preventing tobacco variety "run out"

Tobacco grown for seed should be planted at least half a mile from other tobacco varieties to avoid undesirable natural crossing, recent studies show.

Some natural crossing occurred in seed of plants separated by only a fourth of a mile, in isolation studies made by ARS in cooperation with the Maryland Agricultural Experiment Station. A quarter mile is considered adequate in most States for certified tobacco seed production.

When natural crossing occurs, the resulting seeds are not true to type. In addition, when disease-resistant varieties are grown for seed without adequate isolation from susceptible varieties, natural crossing often results in seeds that produce plants susceptible to disease. ARS plant physiologist J. E. McMurtrey says these findings may explain why new tobacco varieties often "run out"—be-

come like the native type—several years after they are introduced.

The Maryland tests extended through three growing seasons. In the plots adjacent to each other, cross pollination occurred in 2.1, 4.3, and 10.1 percent of the plants. Plots located a quarter mile apart averaged 0.5 percent cross pollination for the 3 years. Separating plots by half a mile generally prevented crossing (0.2 percent crossing occurred one year in one plot).

Degree of isolation is only one factor influencing natural crossing of tobacco varieties. Others include the amount of wind and the number and activity of hawk moths, bees, hummingbirds, all of which carry pollen from nearby fields.

National tick survey is initiated

A nationwide survey of ticks has been initiated by ARS to locate all species capable of transmitting diseases to pets, livestock, and man.

Federal and State regulatory workers are collecting specimens of ticks found during routine inspection work. These specimens are forwarded to Beltsville, Md., for identification by ARS tick specialists.

The need for a tick-species survey was illustrated recently in Florida, where a fever-tick survey turned up localized infestations of the African red tick (*Rhipicephalus evertsi*) at two wild animal compounds. These infestations were eradicated before they could spread to native wild animals or domestic livestock.

Another tick infestation, that of brown dog ticks (*Rhipicephalus sanguineus*), was found on cattle during a follow-up survey in Florida. This tick is common in the United States, but it is generally found on dogs. In Africa, however, strains of the brown dog tick are frequently found on cattle, man, or other hosts. ARS disease-control officials say, therefore, that the brown dog ticks found on cattle in Florida may be a variety or strain from Africa.

Similar infestations of disease-carrying ticks may occur in other areas of the U.S. And regulatory workers feel that detecting and eradicating localized infestations would be much easier and less costly than living with or attempting to eradicate widespread infestations.

Hybrid pine resists weevil

A botany student at the University of California took a walk one day, 25 years ago, in the San Jacinto Mountains of southern California. He picked up a pine cone and put it in his pocket.

The student suspected that the cone was from a hybrid—a natural cross of a Coulter pine and a Jeffery pine. He passed this information on to the Institute of Forest Genetics near Placerville, Calif., where scientists of the U.S. Forest Service were seeking a pine tree that was resistant to the pine reproduction weevil—the most serious threat to California's pine plantations.

Knowledge that the insect-resistant Coulter pine would cross with the lumber-quality Jeffery pine started Institute researchers on their study of the hybrid's resistance to insects.

The researchers found that the weevil attacked only one hybrid pine to every seven Jeffery pines. And now they believe the same hybrid may also show resistance to the pine beetle—a serious threat to mature pine trees.

So, 25 years after the student picked up that peculiar pine cone, the Forest Service has a hybrid with the insect resistance of the Coulter pine and the good lumber quality of the Jeffery pine. And foresters are now growing the hybrid to plant in the National forests in California, hoping to avoid much of the severe loss that has resulted in the past from attacks of the pine reproduction weevil.

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Plans for portable examining table

Farmers and veterinarians who have wrestled a sick pig around a dirty hoglot to examine it will welcome an inexpensive, portable examining table developed by two ARS scientists.

The 62-pound table can be disassembled and stowed in the back seat or trunk of a car, then reassembled easily for small-animal examination. Any handyman can build it for about 10 dollars.

The assembled table features a shallow V-shaped trough to lay the animal in, and a shelf underneath to hold instruments. Ropes and ring cleats, used to restrain the animal, are components of the table.

The unit has four parts held together by removable metal rods. Two boards are hinged together to form the trough. Legs for the table are two panels of plywood with V's cut in the top of each for the trough to rest in. The shelf fits between the legs, beneath the trough.

The table was designed by laboratory technician G. J. Hanosh with help from parasitologist I. H. Roberts, to aid in field-examining sheep for psoroptic scabies, a parasitic infestation. Plans and a list of materials are available from Hanosh at Box 705, Albuquerque, N. Mex.

Mesquite spray rate is lowered

A new, low rate of application of 2,4,5-T for controlling velvet mesquite makes it possible to treat Arizona rangeland in half the time and with half the herbicide formerly needed.

Recent research shows that only 4 gallons per acre of a spray mixture containing a third of a pound of 2,4,5-T is as effective as a previously recommended spray containing three-fourths of a pound of 2,4,5-T per 10 gallons of liquid.

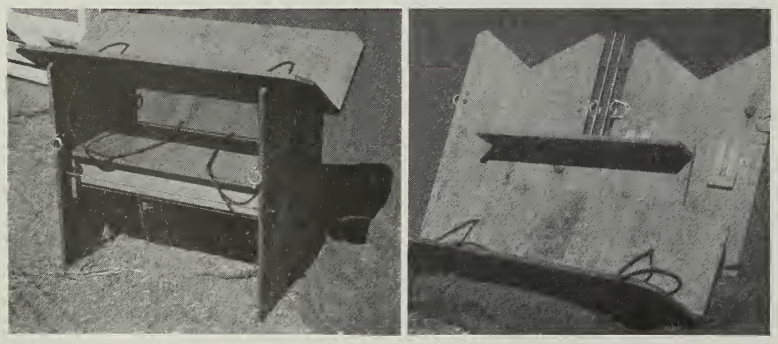
At this new application rate, an airplane can spray more than twice as much acreage per flight.

Two treatments of 2,4,5-T at the ⅓-pound rate, applied by air 1 to 3 years apart, reduced a velvet mesquite stand 60 percent and resulted in a top kill of up to 95 percent. The herbicide was applied in a mixture of 1 part diesel oil and 7 parts water. The tests were conducted by ARS range conservationist F. H. Tschirley in cooperation with the Arizona Agricultural Experiment Station.

The timing of each application is very important, the scientist found. Velvet mesquite is most susceptible to 2,4,5-T in the spring as soon as the leaves have reached full size and when terminal elongation of new twigs has stopped.

The proper interval—1 to 3 years—between the first and second applications depends on how rapidly the velvet mesquite recovers following the first treatment. The research indicates the two treatments will be effective for 5 to 10 years against this weed, which predominates on arid portions of the mesquite rangeland.

Users of 2,4,5-T are cautioned to follow label instructions and to keep this spray away from broad-leaved field crops. Cotton especially may be damaged by the herbicide. Agricultural experiment stations in the Southwestern States should be consulted for detailed recommendations.



Small-animal examining table is inexpensive and can be assembled in less than five minutes. The unit breaks down for carrying in trunk of a car.

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